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Reproductive indices of Merino rams fed sun-cured *Leucaena leucocephala* forage

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Introduction

Little information is available on the effect of *Leucaena leucocephala* (leucaena) forage on the reproductive performance of male animals. Some investigations have indicated that leucaena caused anoestrous, poor conception and a high percentage of resolved foetuses among female rats (Joshi, 1968) and embryonic death and resorption among heifers grazed virtually on leucaena stands alone (Holmes *et al.*, 1981). In male rats, leucaena caused reduced libido, and spermatozoa recovered from vaginal smears had a lot of detached heads, which led to low rates of fertilization. Lohan *et al.* (1987 a,b) also reported that Murrah male goats had poor semen quality when leucaena comprised 50% of the diet. Based on scrotal size, Kaitho *et al.* (1998) did not observe any detrimental effect of leucaena supplementation in Ethiopian highland sheep. This study examined fertility properties of rams fed eragrotis hay supplemented with *Luecaena leucocephala*, lucerne (*Medicago sativa*) or cottonseed cake.

Materials and Methods

Experiment 1: The influence of leucaena on fertility was investigated in 15 young Merino rams weighing 53 (± 3.6) kg in a study lasting 60 days. Rams were blocked by weight and scrotal circumference into five groups of three animals. Within group, animals were randomly assigned to three dietary treatments. The three diets comprised *ad lib* feeding of Eragrostis hay supplemented with 340 g of either leucaena or lucerne, and lucerne and Eragrostis hay fed in the ratio 23:77 (Control diet).

Experiment 2: Fifteen young Merino rams weighing 54 (± 4.2) kg were blocked by weight and scrotal circumference into five groups of three animals and within each group, animals were randomly assigned to three dietary treatments. Dietary treatments comprised Eragrostis hay fed *ad lib* and supplemented with 750 g of leucaena or 680 g of lucerne or 350g of cottonseed cake (CSC). The quantities of supplements were calculated to ensure that all diets contained about 14% crude protein. Measurements in both studies comprised feed intake, packed cell volume (PCV), blood mineral profiles, testicular and semen properties. Sperm defects were classified as (1) primary or major, including detached heads, abaxial tails, abnormal head shapes, doubles heads, mid piece reflexes, acrosomal defects and proximal protoplasmic droplets; and (2) secondary or minor, including distal protoplasmic droplets, simple reflections of the tails, loose normal heads and distally coiled tails.

Results and Discussion

Results of both experiments are shown in Table 1.

Experiment one: Dietary treatment had no effect ($P > 0.05$) on feed intake, testicular and semen characteristics, live weight gain or scrotal growth. Rams offered the lucerne diet had higher ($P < 0.01$) serum levels of Ca, Mg, Se and PCV than those fed the other two diets. Rams fed the control diet had a higher ($P < 0.01$) serum phosphorus levels compared to those fed lucerne and leucaena diets. There was no significant treatment effect on the serum levels of Zn, Cu and Fe. With the exception of Se, all serum levels were lower than the required levels which may be attributed to a dietary deficiency of these minerals.

Experiment two: Dietary treatment had no effect ($P > 0.05$) on feed intake, testicular and semen characteristics, live weight gain, scrotal growth or the blood concentrations of calcium, copper, iron or magnesium. However, the blood concentration of zinc, phosphorus and selenium were higher ($P < 0.05$) for rams fed the cottonseed diet than for rams fed the other diets. Rams fed the leucaena diets had higher blood Se concentration than those fed lucerne. PCV was not affected by diet. Histological examination of testicular tissue revealed that rams fed on CSC or on leucaena diets had better germ cell activity (i.e. high number of dividing cells) than rams fed on lucerne. Inter-tubular connective tissue was fairly sparse for rams fed on lucerne compared to those fed on either CSC or leucaena diets. Leucaena contains mimosine (which is an anti-nutritive non-protein amino acid). It has been found that mimosine is anti-mitotic (Holmes *et al.*, 1981), while its ruminal degradation product (DHP) can bind with iodine and reduce the output of thyroxine and thyroid stimulating hormone from the anterior pituitary. Given that thyroxine elicits sperm cell maturation (Cook *et al.*, 1993), it is obvious why diets containing

leucaena could adversely affect male fertility indicies. Mimosine has been shown to chelate metal ions (Poonam & Pushpa, 1995). Deficiencies of metal ions such as Zn and Se could result in faulty spermatogenesis or reproductive disorders (Blood *et al.*, 1979; Cheeke *et al.*, 1999).

Table 1 Feed intake, packed cell volume (PCV), testis and sperm characteristics of rams fed (Experiment 1): diets consisting of 23 lucerne : 77 eragrostis hay *ad lib* (control) , or eragrostis hay *ad lib* supplemented with either 340g of lucerne (Luce) or leucaena (Leuc); and (Experiment 2): eragrostis hay *ad lib* supplemented daily with either 680g of lucerne (Luce), 350g of cottonseed cake (CSC) or 750g of leucaena (Leuc).

	Experiment one				Experiment two			
	Control	Luce	Leuc	SED	Luce	CSC	Leuc	SED
Feed intake (g/d)	932	1023	983	90.4	1195	1223	1216	
CP intake (g/d)	95	147	157	-	138	157	182	-
PCV (%)	24.3	26.5	23	1.79**	29.7	30	32.5	9.7
Testis and sperm properties								
Testicular weight (g)	199	208	216	26	285	342	307	31.1
Sperm count (x10 ^{9})#	4.4	5.64	3.88	1.4	0.42	0.8	0.83	0.38
Semen pH	6.76	6.85	6.71	0.13	7.6	7.3	7.6	0.24
Mass motility	3.6	4.2	4.2	0.55	3.5	3.4	4.3	0.87
Semen viscosity	4.4	4.8	5	0.4	3.4	4	3.9	1.07
Primary defects (%)	24.9	30.6	29.9	6.778	15.8	17.2	19.5	7.68
Secondary defects (%)	16.8	22.6	30.8	6.084	28.9	14.6	14.7	10.07

** P<0.01; # : Units are per g of testicular tissue in Experiment 1; and per ml of undiluted semen in Experiment 2.

Conclusion

The lack of dietary effect on testicular and sperm properties is probably an indication that the nutritive potential of these feeds can counterbalance their inherent anti-nutritional properties. This contention derives from previous observations that adequate intake of protein could stimulate scrotal growth. It was concluded that short and long term supplementation of Eragrostis hay with modest amounts of sun-cured leucaena forage has no deleterious effects on ram fertility.

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